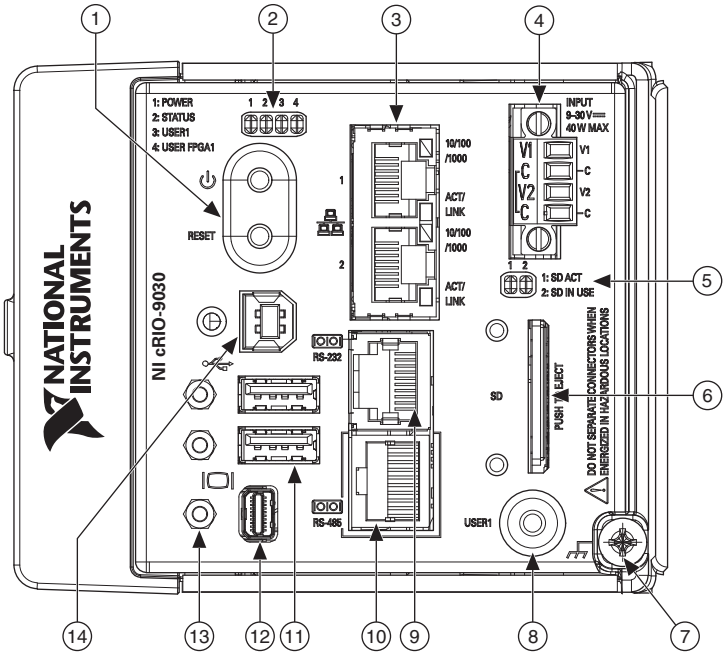
OPERATING INSTRUCTIONS AND SPECIFICATIONS

NI cRIO-9030

Embedded CompactRIO Controller with Real-Time Processor and Reconfigurable FPGA

Figure 1. cRIO-9030 Front Panel



1	RESET Button and Power Button	7	Chassis Grounding Screw	13	Retention Mounts for Mini DisplayPort and USB Ports
2	LEDs	8	USER1 Button	14	USB Device Port
3	RJ-45 Ethernet Ports	9	RS-232 Serial Port	Not Shown: CMOS RESET Button	
4	Power Connector	10	RS-485/422 (DTE) Serial Port		
5	SD Indicator LEDs	11	USB Host Ports		
6	SD Card Removable Storage	12	Mini DisplayPort		

This document describes how to connect the cRIO-9030 to a network, mount the cRIO-9030, and use the features of the cRIO-9030. This document also contains specifications for the cRIO-9030.

NATIONAL INSTRUMENTS

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Safety Guidelines

Caution Do *not* operate the cRIO-9030 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to National Instruments for repair.

Safety Guidelines for Hazardous Locations

The cRIO-9030 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class 1, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9030 in a potentially explosive environment. Failure to follow these guidelines may result in serious injury or death.

Caution Do *not* disconnect the power supply wires and connectors from the controller unless power has been switched off.

Caution Substitution of components may impair suitability for Class I, Division 2.

Caution For Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Caution Do *not* insert or remove SD cards unless power has been switched off or the area is known to be nonhazardous.

Caution The USB host ports, USB device port, mini DisplayPort, and SD card slot require the retention accessories listed in Table 1 for hazardous locations. All cables must be used in a conduit or cable gland to wire to a nonhazardous location. Do *not* disconnect a cable unless the cRIO-9030 is powered off or the area is known to be nonhazardous.

Table 1. Hazardous Location Retention Accessories

Port	Required Accessory	NI Part Number
Mini DisplayPort	Mini DisplayPort Cable Retention Bracket	156866-01
SD Card Slot	SD Door Kit	783660-01
USB Device Port	NI Locking USB Cable	157788-01
USB Host Port	NI Industrial USB Extender Cable	152166-xx

Special Conditions for Hazardous Locations Use in Europe

Some chassis have been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 12 ATEX 1202658X. Each such chassis is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of -20 ≤ Ta ≤ 55 °C.

Caution You *must* ensure that transient disturbances do not exceed 140% of the rated voltage.

Caution The system must be mounted in an ATEX certified enclosure with a minimum ingress protection rating of at least IP 54 as defined in IEC/EN 60529 and used in an environment of not more than Pollution Degree 2.

Caution The enclosure must have a door or cover accessible only by the use of a tool.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

Caution To ensure the specified EMC performance, product installation requires either special considerations or user-installed, add-on devices. Refer to the *Grounding the Chassis* and *Wiring Power to the cRIO Controller* sections for more information.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Exceptions are the input DC power cables, which may be unshielded, and the RS-485 cable, which must be unshielded.

Caution To ensure the specified EMC performance, the length of any cable connected to the video and V2 ports must be no longer than 3 m (10 ft). The length of any cable connected to the USB Host, RS-232, and RS-485 ports must be no longer than 30 m (100 ft).

Caution The USB device port is intended only for use in device configuration, application deployment, debug, and maintenance.

Special Guidelines for Marine Locations

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit `ni.com/certification` and search for the LR certificate, or look for the Lloyd's Register mark on the product label.

Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

Hardware Symbol Definitions

The following symbols are marked on your cRIO controller.

Caution When this symbol is marked on a product, refer to the *Safety Guidelines* section for information about precautions to take.

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Battery Directive This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directives 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit `ni.com/environment/batterydirective`.

Unpacking

The cRIO controller ships in an antistatic package to prevent electrostatic discharge (ESD). ESD can damage several components on the device.

Caution *Never* touch the exposed pins of connectors.

To avoid ESD damage in handling the device, take the following precautions:

- Ground yourself with a grounding strap or by touching a grounded object.
- Touch the antistatic package to a metal part of your computer chassis before removing the device from the package.

Remove the device from the package and inspect it for loose components or any other signs of damage. Notify NI if the device appears damaged in any way. Do not install a damaged device in your computer or controller.

Store the device in the antistatic package when the device is not in use.

What You Need to Install the cRIO-9030

☐ The NI cRIO-9030 shipping kit, which includes the following components:

- NI cRIO-9030 controller
- NI-RIO Device Driver CD

Note NI-RIO 14.0 is the earliest supported driver for the cRIO-9030.

- Two ferrites
- SD card slot cover
- Power screw terminal connector plug
- A-to-B device port USB cable

Caution National Instruments requires the use of a locking USB cable, such as part number 157788-01, in order to meet the shock and vibration specifications of this product.

☐ A host computer running Windows, with NI software installed in the following order:

a. LabVIEW
b. LabVIEW Real-Time Module
c. LabVIEW FPGA Module (recommended)
d. NI-RIO Device Driver

Note Visit `ni.com/info` and enter the Info Code `rdsoftwareversion` to determine which software versions you need to use the cRIO-9030 and supported C Series modules. LabVIEW 2014, the LabVIEW Real-Time Module 2014, and the LabVIEW FPGA Module 2014 are the earliest supported software versions for the cRIO-9030.

☐ A DC power supply as described in the *Power Requirements* section.

☐ C Series I/O modules (optional)

☐ A #2 Phillips screwdriver

☐ A #1 Phillips screwdriver

☐ A small flat-blade screwdriver

☐ Ethernet cable (optional)

☐ Panel, DIN rail, rack or desktop mounting kit (optional)

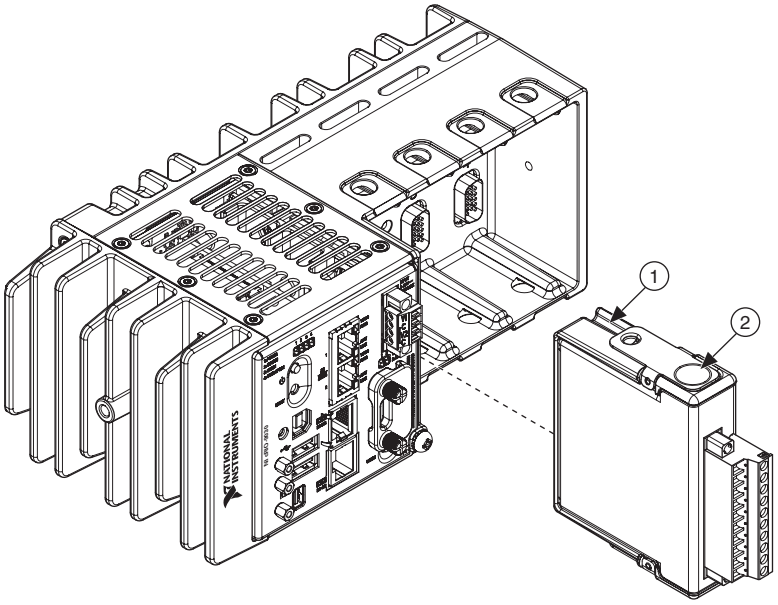
☐ Four M4 screws for mounting the chassis without one of the mounting kits (optional)

Installing C Series I/O Modules in the Chassis

Complete the following steps to install a C Series I/O module in the chassis.

1. Ensure no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis can be powered on when you install I/O modules.
2. Align the I/O module with an I/O module slot in the chassis as shown in Figure 2. The module slots are labeled 1 to 4, left to right.

Figure 2. Installing an I/O Module in the cRIO-9030



1	Insertion Groove	2	Latch

3. Squeeze the latches and insert the I/O module into the module slot.
4. Press firmly on the connector side of the I/O module until the latches lock the I/O module into place.
5. Repeat these steps to install additional I/O modules.

Removing I/O Modules from the Chassis

Complete the following steps to remove a C Series I/O module from the chassis.

1. Ensure no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis can be powered on when you remove I/O modules.
2. Squeeze the latches on both sides of the module and pull the module out of the chassis.

Grounding the Chassis

You must connect the chassis grounding terminal to the grounding electrode system of the facility. Complete the following steps to ground the chassis:

1. Attach a ring lug to a 1.31 mm^2 (16 AWG) or larger wire.
2. Remove the grounding screw from the grounding terminal on the front of the chassis. Refer to Figure 1 for the location of the grounding screw.
3. Attach the ring lug to the grounding terminal.
4. Tighten the grounding screw to 0.5 N · m (4.4 lb · in.) of torque.
5. Attach the other end of the wire to the grounding electrode system of your facility using a method appropriate for the application.

Caution If you use shielded cabling to connect to a C Series I/O module with a plastic connector, you must attach the cable shield to the chassis grounding terminal using 1.3 mm^2 (16 AWG) or larger wire. Attach a ring lug to the wire and attach the wire to the chassis grounding terminal. Solder the other end of the wire to the cable shield. Use shorter wire for better EMC performance.

For more information about ground connections, go to `ni.com/info` and enter the Info Code `emcground`.

Wiring Power to the cRIO Controller

The cRIO controller requires a 9 to 30 V external power supply that meets the specifications in the *Power Requirements* section. Some suggested NI power supplies are listed in Table 8. The cRIO-9030 filters and regulates the supplied power and provides power for the I/O modules.

The cRIO-9030 has a primary power input, V1, and a secondary power input, V2. The POWER LED on the front panel identifies the power input in use. When the LED is lit green, V1 is in use. When the LED is lit yellow, V2 is in use.

If you apply power to both the V1 and V2 inputs, the controller operates from the V1 input. If the input voltage to V1 is insufficient, the controller operates from the V2 input.

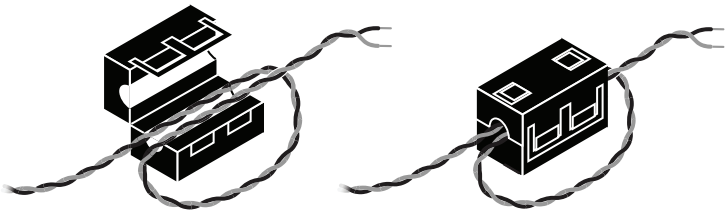
The cRIO-9030 has reverse-voltage protection.

Caution Do *not* connect V2 to a DC mains supply or to any supply requiring a connecting cable longer than 3 m (10 ft). A DC mains supply is a local DC electricity supply network in the infrastructure of a site or building.

Complete the following steps to connect a power supply to the controller.

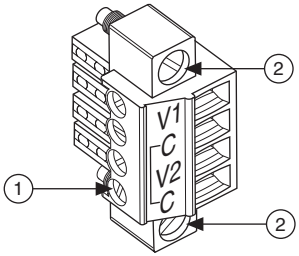
1. Ensure the power source is turned off.
2. Install the ferrite, (National Instruments part number 711849-01, included in the shipping kit) across the negative and positive leads of the power source, approximately 50 to 75 mm (2 to 3 in.) from the end of the power input wires, as shown in Figure 3.

Figure 3. Installing a Ferrite on the Power Leads



3. Loosen the connector screw flanges and remove the power screw terminal connector plug from the cRIO controller. Figure 4 shows the terminal screws, which secure the wires in the screw terminals, and the connector screw flanges, which secure the connector plug on the front panel.

Figure 4. Power Screw Terminal Connector Plug



1	Terminal Screw	2	Connector Screw Flanges

Caution Do *not* tighten or loosen the terminal screws on the power connector while the power is on.

4. Connect the positive lead of the primary power source to the V1 terminal of the power connector plug and tighten the terminal screw to 0.20 to 0.25 N · m (1.8 to 2.2 lb · in.) of torque.
5. Connect the negative lead of the power supply to one of the C terminals of the power connector and tighten the terminal screw to 0.20 to 0.25 N · m (1.8 to 2.2 lb · in.) of torque.
6. Optionally, you can connect the positive lead of another power supply to the V2 terminal and the negative lead to the other C terminal.

Caution The C terminals are internally connected to each other, but are not connected to chassis ground. This isolation is intended to prevent ground loops and does not meet UL ratings for safety isolation. You can connect the C terminals to chassis ground externally. Refer to the *Power Requirements* section for information about the power supply input range. Refer to the *Safety Voltages* section for information about the maximum voltage from terminal to chassis ground.

7. Install the power connector on the front panel of the cRIO controller and tighten the connector screw flanges to 0.3 to 0.4 N · m (2.7 to 3.5 lb · in.) of torque.
8. Turn on the external power source(s).

Powering On the cRIO-9030

When you apply power for the first time to the cRIO-9030, the controller boots into safe mode. The POWER LED illuminates, the STATUS LED illuminates briefly, and then the STATUS LED blinks twice every few seconds.

Note Refer to the *LEDs* section for more information on STATUS LED indications.

You can configure the cRIO-9030 to launch an embedded stand-alone LabVIEW Real-Time application each time you boot the controller. Refer to the *Running a Stand-Alone Real-Time Application (RT Module)* topic of the *LabVIEW Help* for more information.

Using USB to Connect the Controller to the Host Computer

Power on the host computer. Use a USB A-to-B cable, included in the shipping kit, to connect the USB device port of the cRIO-9030, shown in Figure 1, to the host computer.

Caution National Instruments requires the use of a locking USB cable, such as part number 157788-01, in order to meet the shock and vibration specifications of this product.

The device driver software automatically detects the controller on the host computer. If the device driver software does not detect the controller, refer to the *What You Need to Install the cRIO-9030* section and verify the appropriate NI software is installed in the correct order on the host computer before trying again.

Using Ethernet to Connect the Controller to the Host Computer or Network

Connect the controller to an Ethernet network using RJ-45 Ethernet port 1 on the front panel. Use a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable to connect the controller to an Ethernet hub or directly to a computer.

Caution To prevent data loss and to maintain the integrity of your Ethernet installation, do *not* use a cable longer than 100 m.

The first time you connect the controller, it attempts to initiate a DHCP network connection. If the controller is unable to initiate a DHCP connection, it connects to the network with a link-local IP address with the form `169.254.x.x`.

Finding the Controller on the Network (DHCP)

The instructions in this section are for networks using DHCP. If the host computer has a static IP address, refer to the *Finding the Controller on the Network (Static IP)* section. You must use an Ethernet cable to connect the controller to the host computer.

1. Disable secondary network interfaces on the host computer, such as the wireless access card on a laptop.
2. Ensure that any anti-virus and firewall software running on the host computer allows connections to the host computer.

Note NI MAX (Measurement & Automation Explorer) uses UDP 44525. Refer to the documentation of your firewall software for information about configuring the firewall to allow communication through the UDP 44525.

3. Launch NI MAX on the host computer.
4. Expand **Remote Systems** in the MAX configuration tree and find the system. MAX lists the system as the model name followed by the serial number, for example, **NI-cRIO-9030-1856AAA**.

Finding the Controller on the Network (Static IP)

If the host computer has a static IP address, you must temporarily reconfigure it for DHCP, configure the controller, then restore the static IP settings on the host computer.

The following instructions are for host computers running Windows 7. For more information about performing the network configuration steps in this section, go to `www.microsoft.com` and search for `change tcp/ip settings`.

1. Obtain IP settings from the host computer.
   a. Click **Start»Control Panel»Network and Sharing Center**.
   b. Select the primary network connection. It may be called **Local Area Connection** or something similar.
   c. On the dialog box that appears, click **Properties**.
   d. Select **Internet Protocol Version 4 (TCP/IPv4)**, then click **Properties**.
   e. Record the **IP address**, **Subnet mask**, and **Default gateway** address. You will need these to configure the network settings of the cRIO-9030 and to restore the network settings of the host computer.

      You can also record these settings by opening the Start menu, entering `cmd.exe`, and entering `ipconfig` in the command window that appears.
   f. Select **Obtain an IP address automatically**, then click **OK**.
   g. Wait at least one minute.
2. Configure IP Settings on the controller in MAX.
   a. Launch MAX on the host computer.
   b. Expand **Remote Systems** in the MAX configuration tree and find the system. MAX lists the system as the model name followed by the serial number, for example,

NI-cRIO-9030-1856AAA. If you cannot find the system, refer to the *Troubleshooting Network Communication* section.

c. Select the **Network Settings** tab near the bottom of the window.

d. Select **Static** on the **Configure IPv4 Address** control.

e. Enter values for **IPv4 Address**, **Subnet Mask**, **Gateway**, and **DNS Server** based on the information you recorded. Be sure to enter a value for **IPv4 Address** that is not used by another device on the network. For example, do not use the IP address usually assigned to the host computer.

f. Click **Save** and let MAX restart the cRIO-9030. The cRIO-9030 disappears from under **Remote Systems**. You will not see it until you restore the original network settings to the host computer.

g. Restore the original network settings to the host computer.

h. Return to MAX and refresh **Remote Systems**.

Controller Startup Options

You can configure controller startup options in MAX. Select the controller under **Remote Systems** in the MAX configuration tree, then select the **System Settings** tab. You can configure the following options under **Startup Settings**.

- **Force Safe Mode**—When you reboot the controller with this setting on, the controller starts without launching LabVIEW RT or any startup applications. In safe mode, the controller launches only the services necessary for updating configuration and installing software.
- **Enable Console Out**—When you reboot the controller with this setting on, the controller redirects output to the RS-232 serial port. You can use a serial-port terminal program to read the IP address and firmware version of the controller. Use a null-modem cable to connect the RS-232 serial port to a computer. Make sure that the serial-port terminal program is configured to the following settings:
  - 115,200 bits per second
  - Eight data bits
  - No parity
  - One stop bit
  - No flow control
- **Disable RT Startup App**—Rebooting the controller with this setting on prevents any LabVIEW startup applications from running.
- **Disable FPGA Startup App**—Rebooting the controller with this setting on prevents autoloading of any FPGA application.
- **Enable Secure Shell (SSH) Logins**—Rebooting the controller with this setting on starts `sshd` on the controller. Starting `sshd` enables logins over SSH, an encrypted communication protocol.

Note For information about SSH, go to `ni.com/info` and enter the Info Code `openssh`.

- **LabVIEW Project Access**—Rebooting the controller with this setting on enables you to add the target to a LabVIEW project.
- **Enable Embedded UI**—Enables the embedded UI the next time the target is restarted. When you enable the embedded UI, you can interact with the front panels of VIs running on the target using input and display devices connected directly to the target. You can also browse and edit files on the target within a graphical working environment. For more information, refer to the *Using the Embedded UI to Access RT Target VIs* topic in the *LabVIEW Help*.

Configuring the System in Measurement & Automation Explorer (MAX)

After connecting the cRIO-9030 to the host computer, complete the following steps to configure the system for the first time in MAX:

1. Launch NI MAX on the host computer.
2. Expand **Remote Systems** in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**.

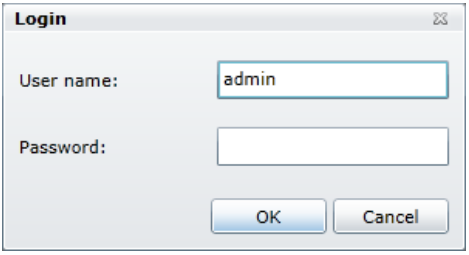
Note If you cannot find the system in the MAX configuration tree, refer to the *Troubleshooting Network Communication* section.

Setting a System Password

1. Right-click the system under **Remote Systems** and select **Web Configuration**. The **Web Configuration** window appears in a browser.
2. Optionally, you can enter a descriptive name for the system in the **Hostname** field. A descriptive name makes it easier to find the system on a network with other devices.
3. Click the **Security Configuration** icon.

The **Security Configuration** window appears.

4. Click **Login** at the top right.
5. Enter **admin** as the user name, leave the **password** field blank, and click **OK**.



6. Click **Change Password**.
7. Enter and re-enter the new password, click **OK**, then click **Save**. A message appears warning that the password is changing and you must login again. Click **OK**.

Note If you forget the system password, you must use the information in the *Worldwide Support and Services* section to contact NI and reformat the controller. NI cannot recover lost system passwords.

Installing Software on the cRIO-9030

1. Return to MAX and expand the system under **Remote Systems** by clicking the arrow beside it.
2. Select **Software**.
3. Click **Add/Remove Software** at the top of the **Software** tab to launch the LabVIEW Real-Time Software Wizard.

Note A login window appears if you set a system password.

4. Select a recommended software set to install.
5. Click **Next**.
6. Select **NI Scan Engine** from the software add-ons.

Note You can use the LabVIEW Real-Time Software Wizard to install more software add-ons later. The Recommended Software Set with the NI Scan Engine add-on is enough to get started with CompactRIO.

7. Click **Next**.
8. Review the summary of software to install. Click **Next** to begin the update.
9. Wait for the installation to finish, then click **Finish**.

Note If you interrupt the software installation process, the cRIO-9030 may be in an unusable state. You must format the hard drive and repeat the installation process.

Adding the cRIO-9030 to a LabVIEW Project

1. Launch LabVIEW. The LabVIEW Getting Started window appears.
2. Click **Create Project**.
3. **Blank Project** should already be selected on the right side of the **Create Project** dialog that appears. Click **Finish**.

Note Alternatively, you can select **Sample Projects»CompactRIO** on the left, then select one of the sample CompactRIO projects to explore.

4. On the **Project Explorer** window that appears, right-click the top-level **Project** item, then select **New»Targets and Devices**.
5. On the **Add Targets and Devices** window that appears, expand **Real-Time CompactRIO**. LabVIEW lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the cRIO-9030 and click **OK**.
6. On the **Select Programming Mode** dialog that appears, click **Continue**. The cRIO-9030 now appears as part of the project in the **Project Explorer** window.
7. You can expand the cRIO-9030 item by clicking the + sign beside it.

Troubleshooting Network Communication

What to Do if the cRIO-9030 Cannot Communicate with the Network

If the cRIO controller cannot communicate with the network, you can perform the following troubleshooting steps.

1. Use a USB A-to-B cable to connect the cRIO controller USB device port, shown in Figure 1, to a host computer.

   When you connect the cRIO controller to the host computer, the USB driver creates a virtual network interface card and assigns an IP address to the cRIO controller in the format of `172.22.11.x`.
2. Launch NI MAX. Expand Remote Systems in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the **Network Settings** tab to configure the IP and other network settings.
3. (Optional) At this point, you can use the RJ-45 Ethernet port 1 to reconnect the cRIO controller to the host computer. The cRIO controller attempts to initiate a DHCP network connection at powerup.

   If the cRIO controller is unable to obtain an IP address, it connects to the network with a link-local IP address with the form `169.254.x.x`. The host computer communicates with the cRIO controller over a standard Ethernet connection.

If you are still experiencing network issues, complete the following steps.

1. Hold the RESET button for 5 seconds, then release it. The STATUS LED turns on, then starts blinking three times every few seconds. The controller is now in safe mode with output from the serial port enabled. You can use a RS-232 serial port terminal to read the IP address of the controller or you can connect a monitor to the mini DisplayPort and view the IP address.
2. To set a new DHCP connection, hold the RESET button for 5 seconds, then release it. The STATUS LED repeats the same behavior. The cRIO controller attempts to establish a new DHCP connection. If the controller fails, it assigns itself a link-local IP address. If the DHCP connection is successful and appropriate for your application, skip to step 4.
3. Launch MAX. Expand Remote Systems in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as **NI-CRIO-9030-1856AAA**. Select the **Network Settings** tab to configure the IP and other network settings.
4. Press and release the RESET button to reboot the controller.

What to Do If You Cannot Find the cRIO-9030 in MAX

If you cannot find the cRIO-9030 in MAX, try the following actions:

- Ensure you have the correct version of NI-RIO installed on the host computer. Go to `ni.com/info` and enter the Info Code `rdsoftwareversion` for the minimum versions of LabVIEW and NI-RIO.

Note If you have recently upgraded LabVIEW, you must reinstall NI-RIO.

- Check the USB cable connections at the cRIO-9030 and host computer. Check the Ethernet cable connections at the host computer and router.
- If you have network firewalls or other security software enabled, try temporarily turning them off. You may also need to add an exception for MAX. In Windows 7, select **Start»Control Panel»System and Security»Windows Firewall»Allow a program through Windows Firewall**. Click **Allow another program**, select **Measurement & Automation**, click **Add**, then click **OK**.
- Ensure that UDP port 44525 is open to communication on the host computer. If you are using an intelligent switch on the network, ensure that it is not disabling UDP port 44525.
- Hold the RESET button for 5 seconds to reboot the target into safe mode. This prevents a real-time application from running. Sometimes a malfunctioning real-time application prevents network communication.
- Check the Device Manager to ensure the National Instruments USBLAN adapter is recognized. In Windows 7, select **Start»Control Panel»Device Manager»Network adapters»National Instruments»USBLAN adapter**. If the USBLAN adapter is not recognized, you must reinstall NI-RIO.

For more information about troubleshooting network communication in MAX, refer to the following locations:

- The *MAX Remote Systems Help*

- *Troubleshooting: I Cannot Find My CompactRIO or Single-Board RIO System in MAX* in the *MAX Help*.
- The *Troubleshooting CompactRIO Controllers in Measurement & Automation Explorer* white paper. Visit `ni.com/info` and enter the Info Code `TroubleshootcRIOMAX`.

Mounting the Controller

In order to obtain the maximum allowable ambient temperature of 55 °C, you must mount the controller horizontally on a flat, vertical surface such as a panel or wall.

You can mount the controller directly to the surface or you can use the NI Panel Mounting Kit. You can also mount the controller in other orientations, on a nonmetallic surface, on a 35 mm DIN rail, on a desktop, or in a rack.

Mounting the controller in these or other configurations can reduce the maximum allowable ambient temperature and can affect the typical accuracy of modules in the controller. Figure 5 shows the controller mounted horizontally.

Before using any of these mounting methods, record the serial number from the back of the chassis. Knowing the serial number makes it easier to find the CompactRIO system in MAX. You will be unable to read the serial number after you mount the controller.

Caution Make sure that no I/O modules are in the chassis before mounting it.

Figure 5. cRIO-9030 Mounted Horizontally

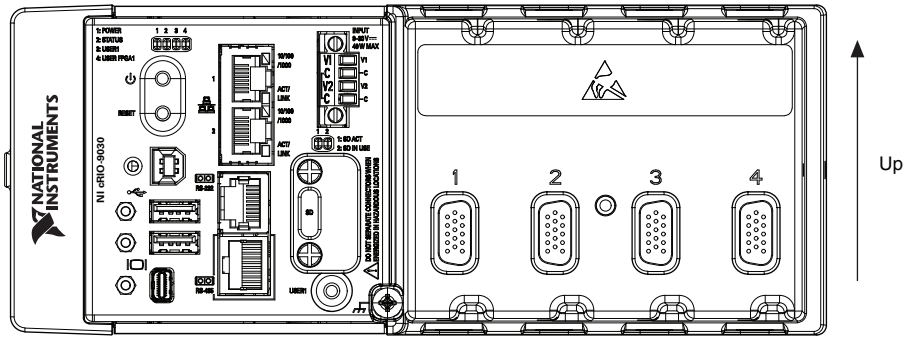
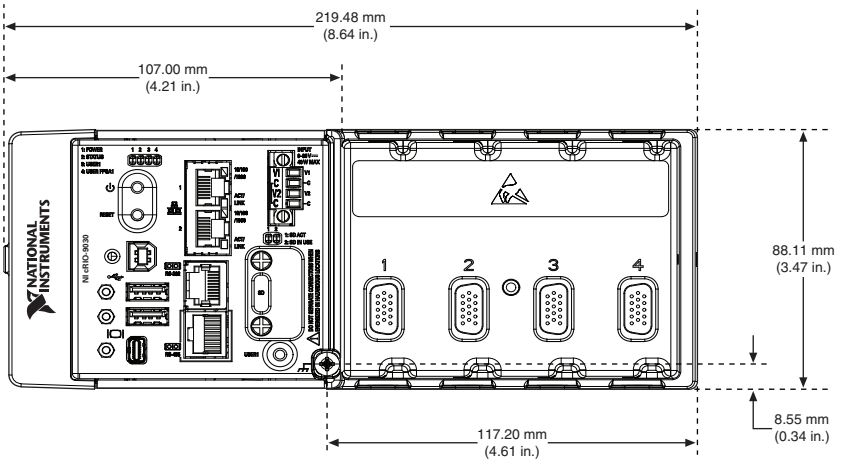


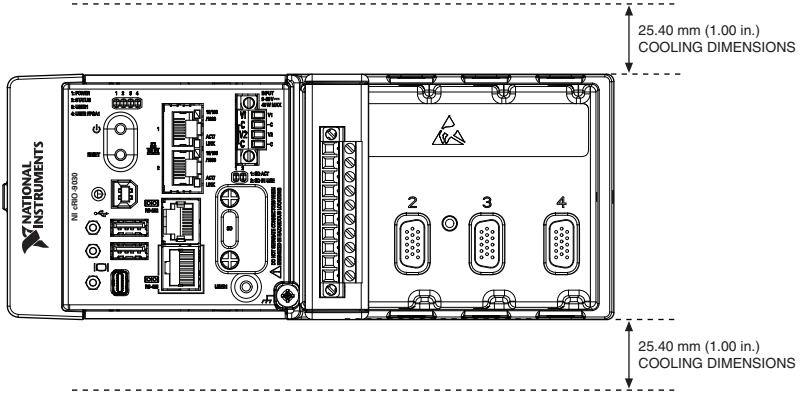
Figure 6. cRIO-9030 Front View with Dimensions



Caution Your installation must meet the following requirements for space and cabling clearance:

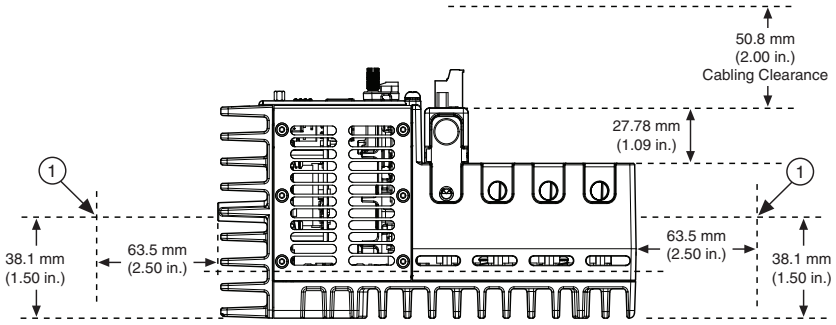
- Allow 25.4 mm (1.00 in.) on the top and the bottom of the controller for air circulation, as shown in Figure 7.
- Allow 50.8 mm (2.00 in.) in front of modules for cabling clearance for common connectors, such as the 10-terminal, detachable screw terminal connector, as shown in Figure 8.

Figure 7. cRIO-9030 Front View with Cooling Clearance



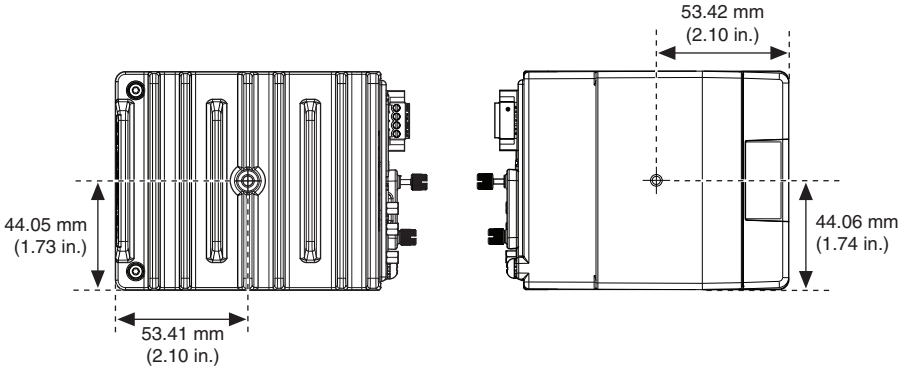
Measure the ambient temperature at each side of the controller, 63.5 mm (2.50 in.) from the side and 38.1 mm (1.50 in.) forward from the rear of the controller, as shown in Figure 8.

Figure 8. cRIO-9030 Bottom View with Cabling Clearance



1 Measure ambient temperature here.

Figure 9. cRIO-9030 Side Views with Dimensions



Note For more information about the dimensions of the controller, including detailed dimensional drawings, go to `ni.com/dimensions` and search `cRIO-9030`.

Note For information about the minimum cabling clearance for C Series modules with other connector types, go to `ni.com/info` and enter the Info Code `rdrioconn`.

Note For more information about mounting the controller in environments with high shock and vibration, go to `ni.com/info` and enter the Info Code `criomounting`.

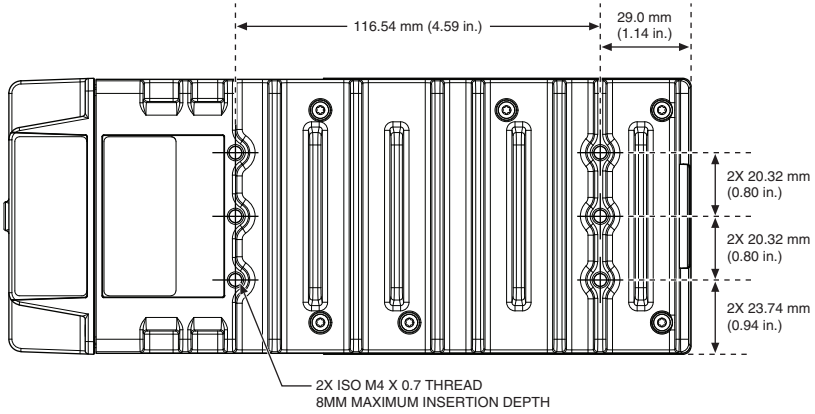
Note For more information about typical accuracy specifications for modules, and temperature deratings caused by different mounting configurations, go to `ni.com/info` and enter the Info Code `criotypical`.

Mounting the Controller Directly on a Flat Surface Using the Mounting Holes

Directly mounting the controller to a flat, rigid surface is the only method for applications with high shock and vibration. Use the mounting holes in the controller to mount the controller directly on a flat, rigid surface.

1. Use the dimensions shown in Figure 10 to prepare the surface for mounting the controller.

Figure 10. cRIO-9030 Surface Mounting Dimensions



2. Align the controller on the surface.
3. Fasten the controller to the surface using four M4 screws appropriate for the surface. Screws must not exceed 8 mm of insertion into the chassis. National Instruments does not provide these screws.

Mounting the Controller on a Panel

You can mount the cRIO controller without a kit by screwing through a flat panel into the four holes on the back of the controller. Use M4 screws with a length suitable for the depth of the panel. Screws must not exceed 8 mm of insertion into the chassis. National Instruments does not provide these screws.

You can use the NI panel mounting kit, part number 157253-01, to mount the controller on a flat surface.

1. Fasten the panel mounting plate to the controller using a #2 Phillips screwdriver and four M4 × 10 screws. National Instruments provides these screws with the panel mounting kit.

You *must* use these screws because they are the correct depth and thread for the panel mounting plate. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).

Figure 11. Installing the Panel Mounting Plate on the Controller

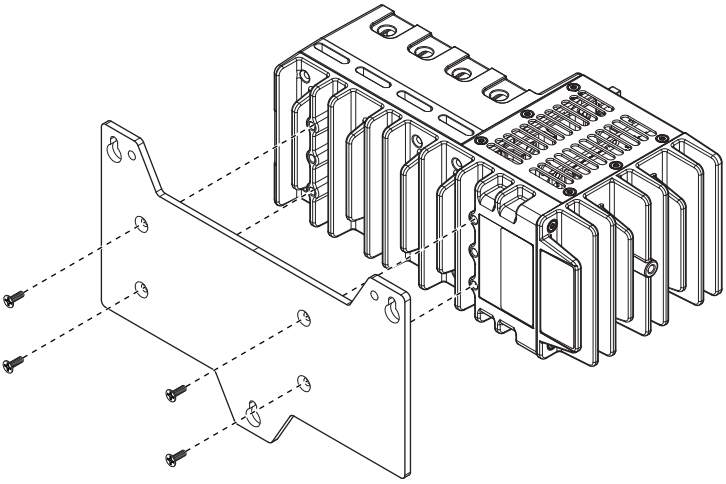
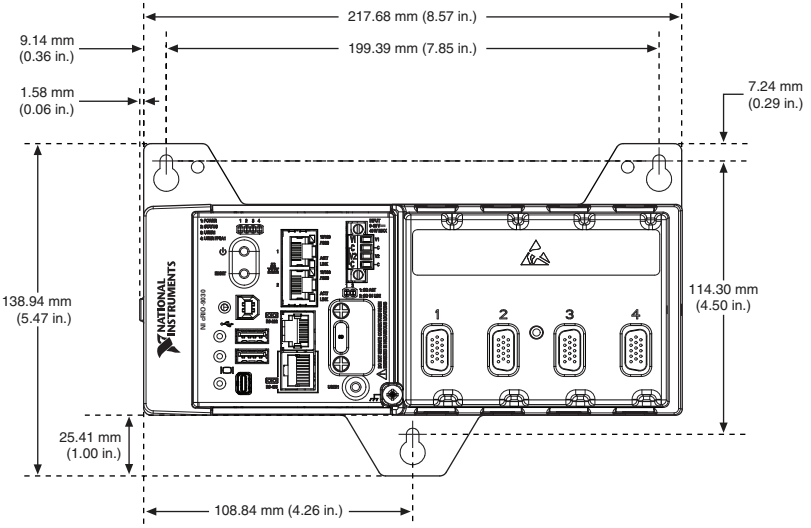


Figure 12. Dimensions of Controller with Panel Mounting Plate Installed



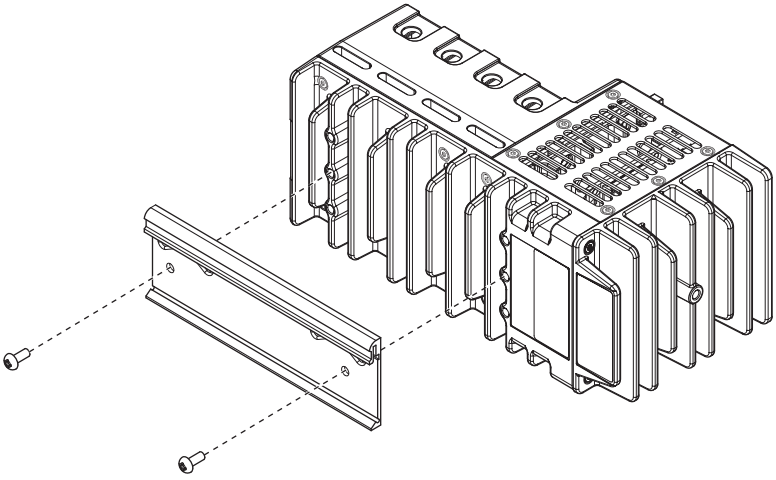
2. Fasten the panel mounting plate to the surface using the screwdriver and screws that are appropriate for the surface. The maximum screw size is M5 or number 10.

Mounting the Controller on a DIN Rail

You can use the NI DIN rail mounting kit, part number 157254-01, to mount the controller on a standard 35 mm DIN rail. You need one clip for mounting the controller on a standard 35 mm DIN rail.

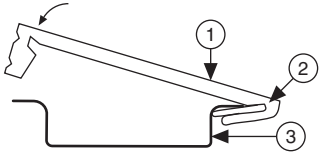
1. Fasten the DIN rail clip to the controller using a #2 Phillips screwdriver and two M4 × 10 flathead screws. National Instruments provides these screws with the DIN rail mounting kit. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).

Figure 13. Installing the DIN Rail Clip on the cRIO-9030



2. Insert one edge of the DIN rail into the deeper opening of the DIN rail clip, as shown in Figure 14.

Figure 14. One Edge of the DIN Rail Inserted in a Clip



1	DIN Rail Clip	2	DIN Rail Spring	3	DIN Rail

3. Press down firmly on the controller to compress the spring until the clip locks in place on the DIN rail.

Caution Ensure no I/O modules are in the chassis before removing it from the DIN rail.

Mounting the Controller on a Rack

NI offers two rack mount kits, part numbers 779102-01 and 781989-01, that you can use to mount the NI cRIO controller and other DIN rail-mountable equipment on a standard 19-inch (482.6 mm) rack. You must order the NI DIN rail mount kit, part number 157254-01, in addition to a rack mount kit.

Mounting the Controller on a Desktop

You can use the NI Desktop Mounting Kit, part number 779473-01, to mount the controller on a desktop.

1. Align one of the end brackets with the mounting hole on one of the ends of the controller.
2. Use a #2 Phillips screwdriver to tighten the captive screw on the end of the bracket.
3. Repeat step 2 to attach the other end bracket.

Figure 15. Front View of the Controller Mounted on a Desktop, with Dimensions

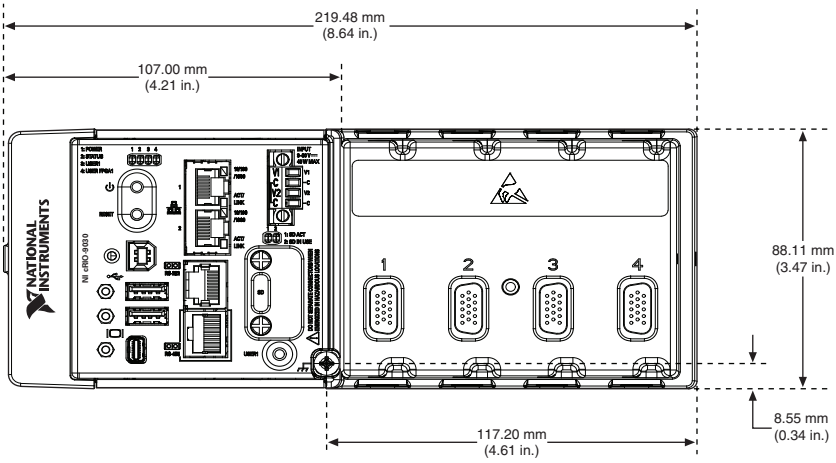
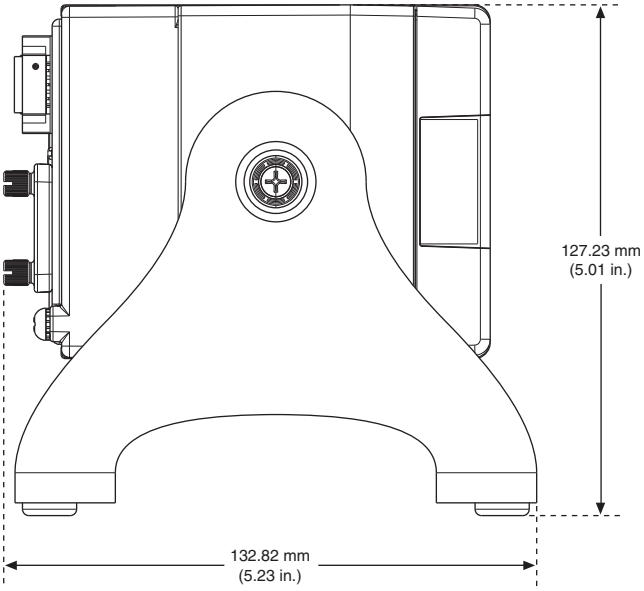


Figure 16. Side View of the Controller Mounted on a Desktop, with Dimensions



cRIO Controller Features

The cRIO controller features many ports, LEDs, a RESET button, a power button, and an SD card slot. Refer to Figure 1 for the locations of these features on the cRIO controller.

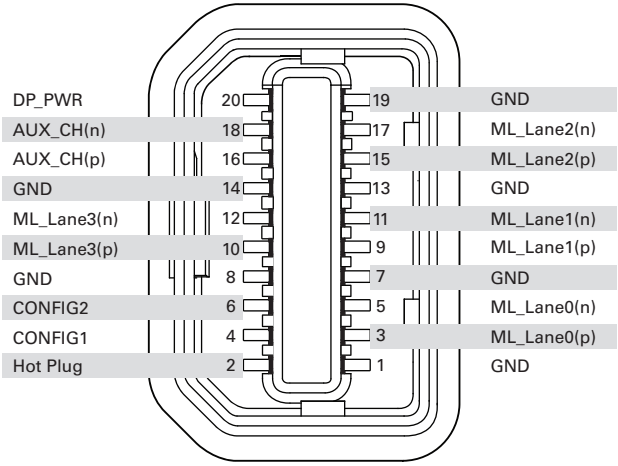
Mini DisplayPort

Use the mini DisplayPort connector, shown in Figure 1, to connect a monitor to implement a local HMI for Real-Time cRIO controllers. You can use a single real-time VI to iteratively develop both your user interface and system logic. For more information, refer to the *Using the Embedded UI to Access RT Target VIs* topic in the *LabVIEW Help*.

Use an appropriate adapter cable, as listed in Table 8, to connect the Mini DisplayPort to VGA or DVI.

Figure 17 lists the mini DisplayPort pins and signals. For up-to-date information about supported NI cables and accessories, refer to the pricing section of the NI cRIO-9030 product page at ni.com.

Figure 17. Mini DisplayPort Pinout



Caution Do *not* hot-swap mini DisplayPort devices while the cRIO controller is in a hazardous location or connected to high voltages.

USB Host Ports

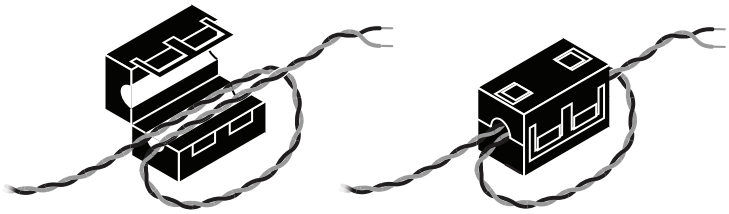
The USB host ports on the cRIO controller support common USB mass-storage devices such as USB Flash drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

LabVIEW usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

Note If the cRIO-9030 is not in a hazardous location, you can connect and disconnect USB devices without affecting operation.

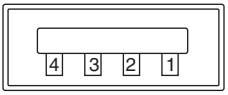
Install a noise-suppression ferrite (National Instruments part number 711849-01, included in the shipping kit) around all attached external USB cables to ensure that your device meets all EMC standards applicable to your country, as shown in Figure 18. The ferrite should be installed so that it is approximately 50 to 75 mm (2 to 3 in.) from the end of the cable that plugs into the USB host port. The ferrite should accommodate both USB cables depending on cable diameter.

Figure 18. Installing a Ferrite on Two USB Cables



Refer to Figure 1 for the location of the two USB host ports on the cRIO controller. Refer to Table 2 for USB host port pin locations and signal descriptions.

Table 2. USB Host Port Pin Locations

Pinout	Pin	Signal Name	Signal Description
	1	VCC	Cable power (+5 V)
	2	D-	USB data-
	3	D+	USB data+
	4	GND	Ground

Caution Do *not* hot-swap USB devices while the cRIO controller is in a hazardous location or connected to high voltages. If the cRIO controller is not in a hazardous location, you can connect and disconnect USB devices without affecting operation.

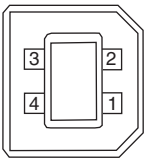
USB Device Port

The USB device port, shown in Figure 1, is intended for use in device configuration, application deployment, debug, and maintenance. For example, you can install software or driver updates through the USB device port during field maintenance instead of interrupting communication on the RJ-45 Ethernet ports.

Caution National Instruments requires a locking USB cable, such as part number 157788-01, in order to meet the shock and vibration specifications of this product.

Refer to Table 3 for USB device port pin locations and signal descriptions.

Table 3. USB Device Port Pin Locations

Pinout	Pin	Signal Name	Signal Description
	1	VCC	Cable power (+5 V)
	2	D-	USB data-
	3	D+	USB data+
	4	GND	Ground

Caution Do *not* hot-swap USB devices while the cRIO controller is in a hazardous location or connected to high voltages. If the cRIO controller is not in a hazardous location, you can connect and disconnect USB devices without affecting operation.

RESET Button

Pressing the RESET button resets the processor in the same manner as cycling power.

You can also use the RESET button to troubleshoot network connectivity:

1. Hold the RESET button for 5 seconds, and then release it to boot the controller in safe mode and enable Console Out.
2. After booting the controller into safe mode, hold the RESET button again for 5 seconds to boot the controller into safe mode, enable Console Out, and reset network adapters to default settings.

For more information about using the RESET button to put the controller into safe mode and troubleshoot network issues, refer to the *Troubleshooting Network Communication* section.

Power Button

The default behavior for the cRIO controller is to power on when you apply power to the controller and power off when you press and release the power button, shown in Figure 1. The behavior of the power button can be configured in the BIOS. If the cRIO controller becomes unresponsive, you can power it off by holding the power button for 4 seconds.

LEDs

The cRIO controller features four LEDs—POWER, STATUS, USER1, and USER FPGA1—on its front panel as shown in Figure 1. Table 4 lists the LEDs and status indications.

Table 4. LED Indications

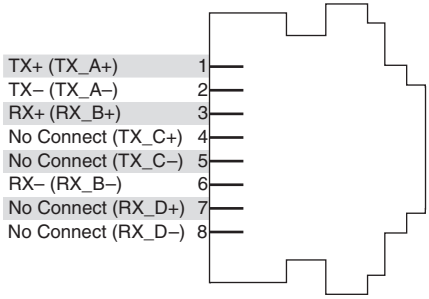
LED	LED Color	LED State	Indication
POWER	Green	Solid	The cRIO controller is powered from the V1 input
	Yellow	Solid	The cRIO controller is powered from the V2 input
	—	Off	The controller is not powered.
STATUS	Yellow	2 flashes every few seconds	There is no software installed, which is the out-of-box state, or the controller has detected an error in its software. An error can occur when an attempt to upgrade the software is interrupted. Refer to the *MAX Help* for information about safe mode.
		3 flashes every few seconds	The controller is in safe mode. Refer to the *MAX Help* for information about safe mode.
		4 flashes every few seconds	The software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the controller runs out of memory. Review your RT VI and check the memory usage. Modify the VI as necessary to solve the memory usage issue.
		Continuously flashing	The controller has not booted into NI Linux Real-Time. The controller either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
		Solid	The controller is booting up.
	Red	Continuously flashing	An internal power supply has failed. Check front-panel I/O and C Series module connections for shorts. Remove any shorts and power cycle the controller. If the problem persists, contact National Instruments.
	—	Off	Normal operation.
USER1	Green/ yellow	—	You can define the USER1 LED to meet the needs of your application. To define the USER LED in LabVIEW Real-Time, use the RT LEDs VI. For more information about the RT LEDs VI, refer to the *LabVIEW Help*.
USER FPGA1		—	Use the LabVIEW FPGA Module and NI-RIO software to define this LED to meet the needs of your application. You can use the USER FPGA1 LED to help debug your application or retrieve application status. Refer to the *LabVIEW Help* for information about programming this LED.

RJ-45 Ethernet Ports

The cRIO controller has two tri-speed RJ-45 Ethernet ports, shown in Figure 1.

Refer to Figure 19 for Ethernet pin locations and signal descriptions. The Ethernet signal names are listed as Fast Ethernet signal name, RX/TX +/-, and then Gigabit Ethernet signal name, (RX/TX_*x*+/-).

Figure 19. Ethernet Port Pin Locations: Fast Ethernet Signals (Gigabit Ethernet Signals)



Note Both Ethernet ports perform automatic crossover configuration so you do not need to use a crossover cable to connect to a host computer.

Both Ethernet ports are enabled and configured to obtain an IP address automatically by default. The Ethernet ports can be configured in MAX.

Ethernet LEDs

Each Ethernet port has two LEDs—ACT/LINK and 10/100/1000—described in Table 5.

Table 5. Ethernet LED Indications

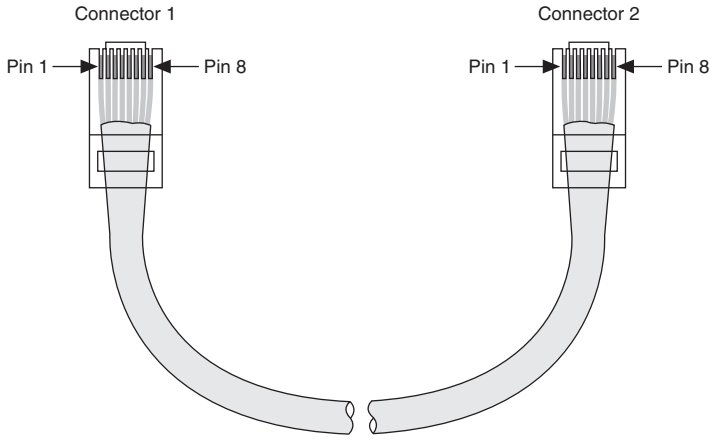
LED	LED Color	LED State	Indication
ACT/LINK	—	Off	LAN link not established
	Green	Solid	LAN link established
		Flashing	Activity on LAN
10/100/1000	Yellow	Solid	1,000 Mbit/s data rate selected
	Green	Solid	100 Mbit/s data rate selected
	—	Off	10 Mbit/s data rate selected

Ethernet Cabling

Table 6 shows the shielded Ethernet cable wiring connections for both straight through and crossover cables.

Table 6. Ethernet Cable Wiring Connections

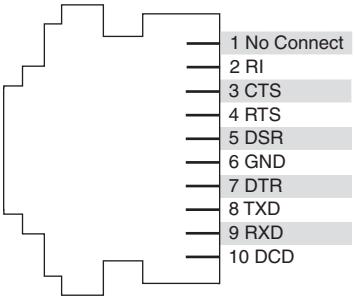
Pin	Connector 1	Connector 2	
		Straight Through	Crossover
1	white/orange	white/orange	white/green
2	orange	orange	green
3	white/green	white/green	white/orange
4	blue	blue	blue
5	white/blue	white/blue	white/blue
6	green	green	orange
7	white/brown	white/brown	white/brown
8	brown	brown	brown



RS-232 Serial Port

The cRIO controller has an RS-232 (RJ50) 10-position modular jack, shown in Figure 1, to which you can connect devices such as displays or input devices. Use the Serial VIs to read from and write to the serial port. Refer to the *LabVIEW Help* for information about the Serial VIs. Refer to Figure 20 for pin locations and signal descriptions.

Figure 20. RS-232 Serial Port Pin Locations



You can use the Ring Indicator (RI) on pin 2 to wake the controller from a low power state. You can drive RI with logic-level signals where a high level greater than 2.4 V signals a wake event.

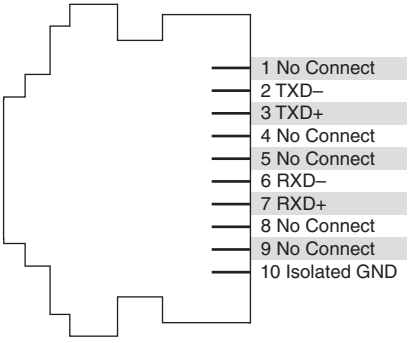
Cable adapters for the RS-232 jack are available from NI. NI part numbers 182845-01, -02, and -03 are 1, 2, and 3 m cable adapters for connecting the 10-position modular jack to a 9-position D-SUB plug.

RS-485/422 (DTE) Serial Port

The cRIO-9030 has an RS-485 serial port accessible through a 10-position RJ-50 modular jack. The RJ-50 connector is isolated from the controller. Refer to the *RS-485/422 (DTE) Serial Port* section of the specifications in this document for information about the electrical isolation of the RS-485 serial port.

Refer to Figure 21 for pin locations and signal descriptions.

Figure 21. RS-485 Serial Port Pin Locations



A cable adapter for the RS-485 jack is available from NI. NI part number 184428-01 is a 1 m cable adapter for connecting the 10-position modular jack to a 9-position D-SUB plug.

Caution To ensure the specified EMC performance, you must use an unshielded cable with the RS-485 serial port, such as NI part number 184428-01, an isolated 1 m RJ-50 to DB-9 cable adapter.

Power Connector

Refer to the *Wiring Power to the cRIO Controller* section and the *Power Requirements* section for more information about the power connector.

SD Card Removable Storage

The cRIO controller features an SD card slot that can read from and write to SD cards. Use an NI-approved SD card to improve the performance and memory integrity of the controller.

LabVIEW usually maps SD cards to the `/U`, `/V`, `/W`, or `/X` drive, starting with the `/U` drive if it is available. Refer to the *LabVIEW Help* for more information.

Caution You *must* use the SD card slot cover to protect the SD card in hazardous locations.

Caution Do *not* insert or remove SD cards unless power has been switched off or the area is known to be nonhazardous.

Note Using SD cards that are not approved by NI might invalidate specifications and result in unreliable performance.

SD Indicator LEDs

The cRIO controller has two LEDs that indicates SD card drive mount status and activity. Refer to Table 7 for descriptions of each of the LEDs.

Table 7. SD Card LED Indications

LED	LED Color	LED State	Description
SD ACT	Yellow	Off	There is no I/O activity on the SD card in the slot.
		Flashing	The cRIO controller is performing I/O on the SD card in the slot. Do *not* remove the SD card while this LED is flashing.
SD IN USE	Green	Off	There is no SD card present in the slot or the cRIO controller has unmounted the SD card from the operating system. It is safe to remove the SD card from the slot.
		Solid	The SD card in the slot is mounted in the operating system. Do *not* remove the SD card while this LED is lit.

SD Card Slot Cover

You *must* use the SD card slot cover to protect the SD card in hazardous locations. Do not remove an SD card while either LED is flashing or lit because file corruption may result.

Caution Removing the SD card while the IN USE LED is lit might result in incomplete or lost data.

Note Screw the slot cover closed completely. Tighten the captive screws to a maximum torque of 0.75 N · m (6.7 lb · in.) using a #1 Phillips screwdriver. Do not overtighten.

USER1 Button

The general-purpose USER1 button is user-defined. You can read the state of the USER1 button from your LabVIEW FPGA application.

Chassis Grounding Screw

For EMC compliance, the cRIO controller *must* be connected to earth ground through the chassis ground, shown in Figure 1.

The wire should be 1.31 mm^2 (16 AWG) solid copper wire with a maximum length of 1.5 m (5 ft). Attach the wire to the earth ground of the facility's power system. Go to `ni.com/info` and enter the Info Code `emcground` for more information about earth ground connections.

Note If you use shielded cabling to connect to a C Series I/O module with a plastic connector, you must attach the cable shield to the chassis grounding terminal using 1.31 mm^2 (16 AWG) or larger wire. Use shorter wire for better EMC performance.

CMOS Battery and CMOS Reset Button

The cRIO controller contains a CMOS battery, a lithium cell battery that stores the system clock information when the controller is powered off. There is only a slight drain on the CMOS battery when power is applied to the cRIO controller power connector. The rate at which the CMOS battery drains when power is disconnected depends on the ambient storage temperature. For longer battery life, store the cRIO controller at a cooler temperature, and apply power to the power connector. Refer to the *CMOS Battery* section in the specifications of this document for the expected battery lifetime.

The `CMOS BATTERY IS DEAD` warning appears onscreen during the power-on self test if the battery is dead and Console Out is enabled. The controller still starts, but the system clock is reset to the date and time of the BIOS release. The battery is not user replaceable. If you need to replace the CMOS battery, contact National Instruments.

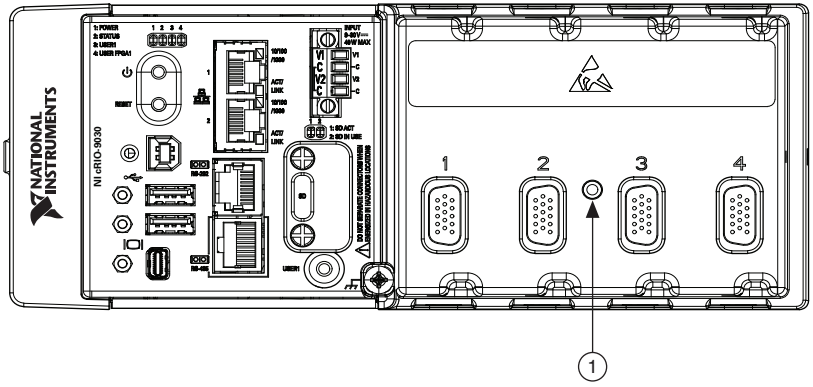
Resetting the System CMOS and BIOS Settings

The cRIO controller BIOS configuration information is stored in a nonvolatile memory location that does not require a battery to preserve the settings. Additionally, the BIOS optimizes boot time by saving specific system information to memory backed up by a battery (CMOS).

Complete the following steps to reset the CMOS and reset the BIOS settings to factory default values:

1. Disconnect power from the cRIO controller.
2. Press the CMOS reset button, as shown in Figure 22, and hold it for 1 second.

Figure 22. The CMOS Reset Button



1 CMOS Reset Button

3. Reconnect power to the cRIO controller.

The `BIOS Reset Detected` warning message appears onscreen.

Note If the CMOS battery is dead, the CMOS reset button will not work.

Power-On Self Test Warning Messages

The cRIO-9030 POST displays warning messages for specific issues onscreen. You can use MAX to enable Console Out to send these warning messages through the RS-232 serial port.

The POST can display the following warning messages:

- **BIOS Reset Detected**—This warning is displayed when the CMOS Reset button has been pushed. This warning indicates that the BIOS settings have the default values.
- **CMOS Battery Is Dead**—This warning is displayed when the CMOS battery is dead and must be replaced. The BIOS settings are preserved even when the CMOS battery is dead, but the system will boot very slowly because the BIOS cannot optimize boot time by saving specific system information to CMOS.

Using the cRIO-9030 File System

The file system of the cRIO-9030 follows conventions established for UNIX-style operating systems. Other LabVIEW Real-Time targets follow Microsoft Windows-style conventions. In order to facilitate the porting of applications from those targets, this target supports the Windows-style `/C` home directory. This path is bound to the UNIX-style directory `/home/lvuser`.

Various LabVIEW Real-Time system files which would be accessible from `C:` (or `/C`) on other LabVIEW Real-Time targets are found in different locations on this target.

UNIX-style file systems support the concept of a symbolic link, which allows access to a file using an alternative file path. For example, it is possible to link `/C/ni-rt/system`, where dynamic libraries are deployed on other LabVIEW Real-Time targets, to `/usr/local/lib`, where they are stored on the cRIO-9030, if the application requires this.

For more information, go to `ni.com/info` and enter the Info Code `RT_Paths`.

Using the Internal Real-Time Clock

The system clock of the cRIO-9030 is synchronized with the internal high-precision real-time clock at startup. This synchronization provides timestamp data to the controller. You can also use the internal real-time clock to correct drift of the system clock. Refer to the *Internal Real-Time Clock* section for the accuracy specifications of the real-time clock.

Cables and Accessories

Table 8 contains information about cables and accessories available for the cRIO controller. Refer to Table 1 for retention cables and accessories for hazardous locations. For a complete list of cRIO controller accessories and ordering information, refer to the pricing section of the NI cRIO-9030 product page at `ni.com`.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Exceptions are the input DC power cables, which may be unshielded, and the RS-485 cable, which must be unshielded.

Table 8. Cables and Accessories

Accessory	Part Number
NI PS-15 Power Supply (24 VDC, 5 A, 100-120/200-240 VAC input)	781093-01
NI PS-10 Desktop Power Supply (24 VDC, 5 A, 100-120/200-240 VAC input)	782698-01
4-POS Gold Power Supply Plugs (Qty 5)	783529-01
Panel Mounting Kit NI cRIO-903x	157253-01

Table 8. Cables and Accessories (Continued)

Accessory	Part Number
DIN Rail Mounting Kit NI cRIO-903x	157254-01
NI Desktop Mounting Kit	779473-01
NI 9910 Sliding Rack Mount Kit	779102-01
NI Rack Mount Kit for cRIO/cRIO	781989-01
SD Industrial Storage Card, 16 GB	783658-01
SD Industrial Storage Card, 32 GB	783659-01
SD Door Kit (Qty 3)	783660-01
NI Locking USB Cable	157788-01
USB Extension with Retention, Type A Connectors (0.5 and 2 m lengths)	152166-0R5, 152166-02
CAT-5E Ethernet Cable, shielded (2, 5, and 10 m lengths)	151733-02, 151733-05, 151733-10
RS-232 Cable Adapters for 10-position Modular Jacks (1, 2, and 3 m lengths)	182845-01, 182845-02, 182845-03
RS-485 Cable Adapters for 10-position Modular Jacks (1 m length)	184428-01
Mini DisplayPort to Full DisplayPort Native Cable	157232-*xx*
Mini DisplayPort to VGA Adapter Cable (0.5 m length)	157230-0R5
Mini DisplayPort Retention Accessory	156866-01

NI cRIO-9030 Specifications

The following specifications are typical for the -20 to 55 °C operating temperature range unless otherwise noted.

Processor

CPU ..... Intel Atom E3825

Number of cores 2

CPU frequency ..... 1.33 GHz

On-die L2 cache ..... 1 MB (shared)

Operating System

Supported operating system ..... NI Linux Real-Time

Software requirement ..... LabVIEW Real-Time 2014 or later

Network/Ethernet Port

Number of ports 2

Network interface ..... 10Base-T, 100Base-TX, and 1000Base-T Ethernet

Compatibility ..... IEEE 802.3

Communication rates ..... 10 Mbps, 100 Mbps, 1000 Mbps auto-negotiated

Maximum cabling distance ..... 100 m/segment

RS-232 Serial Port

Maximum baud rate ..... 115,200 bps

Data bits 5, 6, 7, 8

Stop bits 1, 2

Parity ..... Odd, Even, Mark, Space

Flow control ..... RTS/CTS, XON/XOFF, DTR/DSR

RI wake maximum low level ..... 0.8 V

RI wake minimum high level ..... 2.4 V

RI overvoltage tolerance ..... ±24 V

RS-485/422 (DTE) Serial Port

Maximum baud rate ..... 115,200 bps

Data bits 5, 6, 7, 8

Stop bits 1, 2

Parity ..... Odd, Even, Mark, Space

Flow control ..... XON/XOFF

Wire mode ..... 4-wire, 2-wire, 2-wire auto

Isolation voltage ..... 60 VDC continuous, port to earth ground

Note The RS-485 serial port ground and shield are not connected to chassis ground. This isolation is intended to prevent ground loops and does not meet UL ratings for safety isolation.

Cable Requirement ..... Unshielded, 30 m max length (limited by EMC/surge)

Note RS-485 is capable of 1.2 km (4,000 ft) length without surge limitation.

USB Ports

Number of ports

- Device ports ..... 1 standard B connector
- Host ports ..... 2 standard A connectors

USB interface ..... USB 2.0, Hi-Speed

Maximum data rate ..... 480 Mb/s per port

Maximum current (USB Host Ports) ..... 1 A (aggregate)

Mini DisplayPort

Maximum resolution ..... 2560 × 1600 at 60 Hz

SD Card Slot

SD card support ..... SD and SDHC standards

Memory

Nonvolatile[1]

- SD removable (user supplied) ..... Up to 32 GB
- SSD 4GB

System memory ..... 1 GB DDR3L

Note For information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory, go to `ni.com/info` and enter Info Code `ssdbp`.

Data throughput

- System memory to SD removable storage[2] ..... 10 MB/s
- Module slots to system memory ..... 20 MB/s, application and system dependent

Reconfigurable FPGA

FPGA type ..... Xilinx Kintex-7 7K70T

Number of flip-flops 82,000

Number of 6-input LUTs 41,000

Number of DSP slices (18 x 25 multipliers) 240

Available block RAM ..... 4,860 kbits

[1] 1 MB is equal to 1 million bytes. 1 GB is equal to 1 billion bytes; formatted capacity might be less.

[2] Consult the SD removable storage manufacturer's specifications.

Number of DMA channels.....16

Internal Real-Time Clock

Accuracy .....200 ppm; 40 ppm at 25 °C

CMOS Battery

Typical battery life with power applied to power connector.....10 years

Typical battery life in storage up to 25 °C.....7.8 years

Typical battery life in storage up to 85 °C.....5.4 years

Power Requirements

Caution You must use a UL Listed ITE power supply marked *LPS* with the cRIO-9030.

Note Some C Series I/O modules have additional power requirements. For more information about C Series I/O module power requirements, refer to the C Series I/O module(s) documentation.

Voltage input range.....9 to 30 V (measured at the NI cRIO-9030 power connector)

Maximum power consumption .....40 W

Note The maximum power consumption specification is based on a fully populated system running a high-stress application at elevated ambient temperature, and with all C Series modules and USB devices consuming the maximum allowed power.

Typical standby power consumption.....3.4 W at 24 VDC input

Recommended power supply .....100 W, 24 VDC

Typical leakage current from secondary power input (V2) while system is powered from primary power input (V1)

- At 9 V .....0.4 mA
- At 30 V .....1.93 mA

Caution Do *not* connect V2 to a DC mains supply or to any supply requiring a connecting cable longer than 3 m (10 ft). A DC mains supply is a local DC electricity supply network in the infrastructure of a site or building.

EMC ratings for inputs as described in IEC 61000

- V1 ..... Short lines, long lines, and DC distributed networks
- V2 ..... Short lines only

Power input connector ..... 4-position 3.5 mm pitch-pluggable screw terminal with screw locks, Sauro CTF04BV8-AN000A

Physical Characteristics

Weight (unloaded) ..... 1,800 g (3 lb, 15 oz)

Dimensions (unloaded) ..... 219.5 mm × 88.1 mm × 106.8 mm (8.64 in. × 3.47 in. × 4.21 in.)

Screw-terminal wiring

- Gauge ..... 0.5 to 2.1 mm^2 (20 to 14 AWG) copper conductor wire with 6 mm (0.24 in.) of insulation stripped from the end
- Temperature rating ..... 85 °C minimum

Wires per screw terminal 1

Torque for screw terminals ..... 0.2 to 0.25 N · m (1.8 to 2.2 lb · in.)

Connector securement

- Securement type ..... Screw flanges provided
- Torque for screw flanges ..... 0.3 to 0.4 N · m (2.7 to 3.5 lb · in.)

If you need to clean the controller, wipe it with a dry towel.

Caution The protection provided by the NI cRIO-9030 controller can be impaired if it is used in a manner not described in this document.

Safety Voltages

Connect only voltages that are below these limits.

V1 terminal to C terminal ..... 30 VDC max, Measurement Category I

V2 terminal to C terminal ..... 30 VDC max, Measurement Category I

Chassis ground to C terminal ..... 30 VDC max, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do not connect the system to signals or use for measurements within Measurement Categories II, III, or IV.

Note Measurement Categories CAT I and CAT O (Other) are equivalent. The input circuits are not intended for direct connection to the MAINs building installations of Categories CAT II, CAT III, or CAT IV.

Environmental

Temperature (IEC-60068-2-1 and IEC-60068-2-2)

Operating ..... -20 to 55 °C

Storage..... -40 to 85 °C

Caution Failure to follow the mounting instructions in the *Mounting the Controller* section can cause temperature derating. For more information about mounting configurations and temperature derating, go to `ni.com/info` and enter Info Code `criomounting`.

Ingress protection ..... IP 20

Operating humidity (IEC 60068-2-56) ..... 10 to 90% RH, noncondensing

Storage humidity (IEC 60068-2-56)..... 5 to 95% RH, noncondensing

Pollution Degree (IEC 60664) 2

Maximum altitude ..... 5,000 m

Indoor use only.

Hazardous Locations

U.S. (UL) ..... Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4

Canada (C-UL) ..... Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4

Europe (DEMKO) ..... Ex nA IIC T4 Gc

Shock and Vibration

To meet these specifications, you must mount the controller on a flat, rigid surface as described in the *Mounting the Controller Directly on a Flat Surface Using the Mounting Holes* section, affix ferrules to the ends of the terminal wires, install an SD card cover (NI part number 783660-01), and use the NI Industrial USB Extender Cable (NI part number 152166-*xx*), NI Locking USB Cable (NI part number 157788-01), and NI Retention Accessory for Mini DisplayPort (NI part number 156866-01). All cabling should be strain relieved near input connectors. Take care to not directionally bias cable connectors within input connectors when applying strain relief.

Operating vibration

Random (IEC 60068-2-64)..... 5 g_{rms}, 10 to 500 Hz

Sinusoidal (IEC 60068-2-6) ..... 5 g, 10 to 500 Hz

Operating shock (IEC 60068-2-27)..... 30 g, 11 ms half sine, 50 g, 3 ms half sine, 18 shocks at 6 orientations

Safety and Hazardous Locations Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2006/95/EC; Low-Voltage Directive (Safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

Online Product Certification

To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit `ni.com/environment/weee`.

Battery Replacement and Disposal

Battery Directive This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit `ni.com/environment/batterydirective`.

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